

Modeling Joule Heating Effect on Lunar O₂ Generation via Electrolytic Reduction.

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Kennedy Space Center is leading research work on lunar O₂ generation via electrolytic reduction of regolith; the metal oxide present in the regolith is dissociated in oxygen anions and metal cations leading to the generation of gaseous oxygen at the anode and liquid metal at the cathode.

Electrical resistance of molten regolith is high, leading to heating of the melt when electrical current is applied between the electrodes (Joule heating). The authors have developed a 3D model using a rigorous approach for two coupled physics (thermal and electrical potential) to not only study the effect of Joule heating on temperature distribution throughout the molten regolith but also to evaluate and optimize the design of the electrolytic cell:

This paper presents the results of the thermal analysis performed on the model and used to validate the design of the electrolytic cell.

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REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) 01-05-2009		2. REPORT TYPE Abstract of a paper for AIAA meeting		3. DATES COVERED (From - To) 08-07-2008	
4. TITLE AND SUBTITLE Modeling Joule Heating Effect on Lunar O2 Generation via Electrolytic Reduction.				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Dominguez Jesus A. Poizeau Sophie Sibille Laurent				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ASRC Aerospace Corporation Massachusetts Institute of Technology				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSORING/MONITOR'S ACRONYM(S)	
				11. SPONSORING/MONITORING REPORT NUMBER	
12. DISTRIBUTION/AVAILABILITY STATEMENT					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Kennedy Space Center is leading research work on lunar O2 generation via electrolytic reduction of regolith; the metal oxide present in the regolith is dissociated in oxygen anions and metal cations leading to the generation of gaseous oxygen at the anode and liquid metal at the cathode. Electrical resistance of molten regolith is high, leading to heating of the melt when electrical current is applied between the electrodes (Joule heating). The authors have developed a 3D model using a rigorous approach for two coupled physics (thermal and electrical potential) to not only study the effect of Joule heating on temperature distribution throughout the molten regolith but also to evaluate and optimize the design of the electrolytic cell.					
15. SUBJECT TERMS Joule heating, lunat oxygen generation, molten regolith electrolysis, thermal analysis.					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 1	19a. NAME OF RESPONSIBLE PERSON Jesus A. Dominguez
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER (Include area code) (321) 867-6696